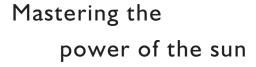
# MASTERVOLT SOLAR POWER SYSTEMS



Light and heat. The power to stay healthy. The capacity to grow. The sun is the sustainable source of energy for life on this planet. And thanks to modern technology, we can optimise the output taken from this energy. The sun is a shining example of efficient power generation without harming the environment. Turning solar energy with the best possible output into electrical power that comes out of a socket is the ultimate challenge. And this is where Mastervolt comes in.



Mastervolt develops and manufactures top-quality power electronics that converts the power of the sun into usable electrical energy. Equally at home with grid connected and autonomous applications, Mastervolt is a vital link in PV systems throughout the world.









#### Mastervolt:

#### A partner with power

A reliable energy supply in all places and at all times. With this mission, Mastervolt has developed into a leading player in a wide range of markets over the past decade. On a global scale, Mastervolt now plays a key role in the fields of mobile and maritime power provision, both recreational and professional. And the same applies to solar energy. Mastervolt offers the craftsmanship, expertise and products you need to turn the power of the sun into high-quality energy.









#### Mastervolt:

#### Master grid connected inverter systems

Mastervolt string inverters are integrated in high-tech dual-axle solar tracking systems. These systems increase the production of photovoltaic solar energy by more than 35% compared to fixed installations. The photograph shows recently installed systems in Navarra, Spain, utilizing Sunmaster solar inverters.





### Custom-made power:

#### The Sunmaster series

Developed for grid connected applications and offering an exceptionally high efficiency, Mastervolt Sunmaster inverters get the most out of solar panels. Switch mode technology makes bulky and heavy transformer technology superfluous. As a result, the Sunmaster inverters are exceptionally compact and lightweight. Monitoring via the PC is standard, and an extensive data logging system is available as an option.

#### The power of global experience

Partnering with Mastervolt brings you all the benefits of international experience and know how. Whether standalone or connected to the grid, our high-tech equipment is installed throughout the world by those who value a reliable and sustainable energy supply. From isolated villages in Nicaragua to mountain towns in Spain. From new residential projects in Germany to the Philippine countryside. From America to Asia and Australia.

In close cooperation with local utility companies and solar module providers, Mastervolt ensures that the sun's power is used for the benefit of people. For the grid connected PV market alone, Mastervolt has an installed base of more than 250,000 solar inverters around the world.

standards and conforms to national requirements. In doing so, we ensure safe operation together with utility companies and installers of on-site photovoltaic systems.



#### Mastervolt:

#### Master autonomous power systems

Electrical power supply is the basis for development. A lamp light allowing a book to be read at night. The power to operate a refrigerator. The benefits of Mastervolt stand-alone equipment are seen worldwide, from a bamboo house in Africa to a rural school in Central America. This is the other specialty of Mastervolt equipment: Powering rural locations without a utility grid connection.









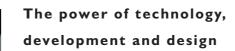












Thanks to our range of high tech products, Mastervolt has become a leading A-brand in the mobile and maritime markets. And our equipment is an equally essential part of the fast-growing solar market. Every product is designed to meet the most stringent requirements. Our research and development team constantly seeks new ways to translate tomorrow's technology into improved performance today. Every part is designed to play a reliable role within an electrical power system. And a regular supply of new innovations offers increased efficiency and output. Practical experience shows the power of our approach... Mastervolt is the beating heart of countless solar energy systems.

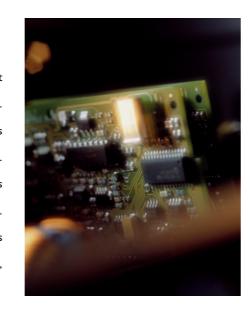


#### The power of comfort and accessibility

Mastervolt equipment has proved its worth in daily practice. Each of our products sets a new standard in reliability, ease of installation and comfort. Accessible monitoring functions offer a complete overview of performance. Thanks to the small dimensions of the Sunmaster, it is easy to find a suitable place for installation. The carefully considered design with a neatly arranged LCD read-out further optimises the user-friendliness.

#### No weak links

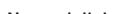
Vital functions are controlled with the utmost precision by powerful microprocessors. Meticulously developed control electronics protect the system from malfunctioning. Smart temperature controlled cooling fans perform their task in absolute silence. Each link in a Mastervolt system makes its own contribution to the overall reliability, sustainability and user friendliness.



#### Clear monitoring functions

Mastervolt data control monitoring facilitates extra output for larger grid connected solar systems, for example in a housing estate. The monitoring guarantees you optimal control. Poor performance due, for instance, to shading on the roof, is quickly registered. Permanent data monitoring offers a clear insight into the output per hour, day or year.





2010+00+00





# Production and control in your own hands

As one of the most delicate parts of a PV system, the Mastervolt inverter or combi is responsible for numerous vital functions. These include accurate converting of DC array voltage to AC power, providing information on DC and AC output as well as volts and amps, and system security. Manufactured according to ISO 9001:2000, Mastervolt solar inverters meet the highest standards. Every product and component is thoroughly examined with an ICT computerised test before delivery.



#### Education and training

In addition to the quality of our products,

Mastervolt's reputation for reliability is also due to a
service network that offers fast local support.

Thanks to a continuous education and training
programme, our dealers are always up to speed with
the latest developments and fully trained to safely
install Mastervolt equipment. Our solar specialists
are dedicated to this sector and will be pleased to
offer you advice and support on any project.

# The sustainable power of worldwide service and support

Mastervolt is committed to sustainable relationships as well as sustainable power. Nowhere is this more apparent than in our service and support network, which is spread across more than 50 countries. Setting up a new solar energy project? Extending or adapting an existing system? An experienced Mastervolt specialist and system adviser will be there to help you.

#### On-time delivery

At Mastervolt, we take our obligations in terms of meeting after-sales guarantees very seriously. Our logistical approach is geared towards on-time delivery, regardless of the size of your project. In this way, we make sure that our customers can always rely on Mastervolt.





#### The power of 24-hour service

It is essential that power electronics equipment is completely reliable. Mastervolt underlines its commitment to this principle by offering a worldwide extended warranty on all products: The Mastervolt Guarantee Plan. Should an unsolvable breakdown occur, our experts are ready to assist you 24 hours a day. Wherever you are in the world.



#### www.mastervolt.com:

#### Always up to date

A vital part of our communication is the extensive web site, offering accurate information about products, projects and events. Our extended support area contains literally all operating manuals, technical and commercial documents, and software.



Mastervolt solar inverters offer tailor made power for every configuration, large or small. Leading edge technology ensures that the energy supplied by solar cells is of a consistently high quality and optimally efficient. And our 'SysCalc' calculation tool means it couldn't be easier to choose the right Mastervolt inverter for your needs.

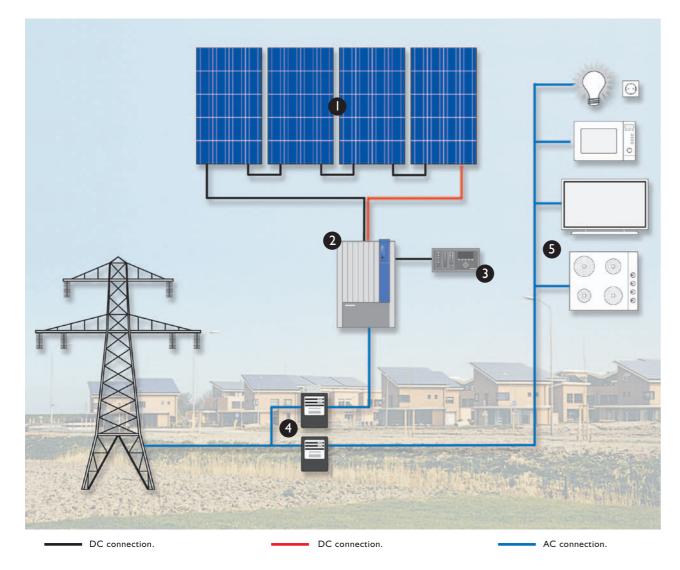
# Solar power conversion & monitoring solutions

#### Grid connected applications

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The Mastervolt inverter is the dynamic heart of any grid connected PV system. The power conversion system takes place with minimal power loss and maximum reliability, while extensive system monitoring offers accurate actual and historical data.

The products available for these applications are described on the following pages. The diagram below shows all the ingredients of a grid connected power system.



#### Basic equipment required for a grid connected system:

I. Solar modules (not provided by Mastervolt).

12

- 2. Mastervolt solar inverter with integrated kWh meter.
- 3. Mastervolt data logger for monitoring (optional).
- 4. A kWh meter for the registration of generated and used power (not provided by Mastervolt).
- 5. Energy consumers in the house (not provided by Mastervolt).



#### The heart of any PV system

Mastervolt solar inverters convert direct current generated by the photovoltaic strings into alternating current and feed it into the public mains. At the same time they are used for system monitoring. These extremely compact, easy-to-mount and lightweight devices offer the highest annual efficiency rates, high reliability and extensive monitoring functions.

The various models cover a performance range of 100 to 7200 Wp. PV systems with low to very high outputs can be configured flexibly: one input (Soladin 600, QS1200 and QS2000), two inputs (QS3200) or four inputs (QS6400) with independent MPP trackers are available to which two module strings of the same design can be connected. In addition, two-phase feeding into the mains above 5 kW is possible with the QS6400.

On the output side the devices can be connected in parallel in any desired combination and number. The standard models convert string currents up to 7.5 A (QS1200: 5 A) and string voltages from 100 to 380 V DC per input with MPP control. The models QS3200 and QS6400 Max-I, especially designed for high-current modules, convert 10 A and 75-260 V DC.

#### **Industry leading benefits**

Mounted in robust aluminium cabinets and designed for use in closed rooms, our inverters convert power with the latest high-frequency technology.

There are numerous advantages:

- Exceptional efficiency offers high yield scores (even in the partial load range) and minimal standby and night consumption.
- The complete electronics for power conversion fits on a single or double circuit board, hence the compact design.
- The cooling requirement is low; cooling is effected by temperature-controlled and maintenance-free ventilators.
- The output voltage only slightly deviates from the pure sine wave shape of the grid (THD < 3% at nominal load).</li>
- The galvanic isolation in the high frequency transformer between DC input and AC output ensures optimised system safety.

A high capacity microprocessor precisely regulates all inverter functions, measures all output data and monitors the correct functioning of the inverter, the connected photovoltaic strings and the power grid. The respective data can be shown on an optional display or via the integrated communication interfaces.

Mastervolt solar inverters comply with international standards. Country-specific models are supplied with the respective nationally approved anti-islanding safety equipment in case of power failure: in most countries the QS anti-islanding will comply. For Germany and Austria we deliver the QS solar inverters as ENS models in full compliance with VD V E0126. In addition, various safety circuits prevent damages or failures caused by incorrect operating conditions.







Article no. Soladin 600 (solar energy)	130000600 (Italy: 130000610 / Spain: 130000620 / UK: 130000630)
Article no. Windmaster 500 (wind energy)	140000500
GENERAL	
Work temperature / storage temperature	-20° C to 40° C / -20° C to 70° C
Relative humidity	max. 95% not condensating
Protection degree / safety class	IP23 / class II
Dimensions	365 x 143 x 76 mm
Weight	2 kg
Casing	plastic (ABS)
SOLAR INPUT (DC)	
Nominal power	535 W / 600 W max.
PV power	160-700 Wp
MPP voltage	40-125 V DC
Maximum voltage	155 V DC
Nom. rated current	8 A
Starting up power	I W DC @ 40 V DC
DC connection	MultiContact 4 mm
GRID OUTPUT (AC)	
Voltage	230 V (184-265 V, programmable)
Maximum power	2.25 A
Fuse	3.15 A slow
Frequency**	50 Hz (49,8-50,2 Hz)
Cos phi	0.99
Zero load	< 0.05 W AC
European output / max. output	91% / 93%
AC connection	Euro socket
READ OUT FUNCTION	
Indicator	two LEDs, yellow and red
Correct working	flashes yellow (speed of flashing is in relation to the power generated)
Malfunction grid or inverter	red (6 different flashing codes)
PROTECTIONS	
Island protection: monitoring of voltage and frequency frame,	disconnects within 100 ms. ENS not available.
Protection of peak capacity: automatic control, dependent on	the temperature of the converter, by raising the Vmpp.
It is impossible to damage the converter with too much power	er.
Temperature protection: reducing the power in case of a high	er temperature of the converter, will disconnect above 80 °C.
DC polarity protection: DC connection is protected (MC con	
NORMS	
CE	yes
EMC guideline	EMC 89/336/EEC
Emission	EN 50081-1
Harmonisation	EN 61000-3-2
Immunity	EN 50082-2
LV guideline	LV 73/23/EEC
Safety	EN 60950

<sup>\*</sup> Products developed for countries where an ENS circuit is not required. Fitted with QNS anti-islanding as standard.

# Y EAR.

#### **SUN & WIND APPLICATIONS**

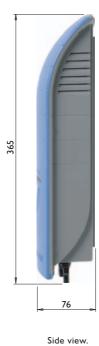




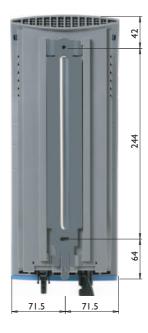
#### **DIMENSIONS IN MM**



Front view of the Soladin 600 with clearly visible the intelligent LED human interface.



rly t



Rear view installation bar delivered as standard.

#### ACCESSORIES





PC-Link with 6 metre cable, for system and unit monitoring on the computer, art. no. 130391030.



Soladin 600 Wizard software, for monitoring on the computer (freeware from www.mastervolt.com).





<sup>\*\*</sup> UL versions not available. 240V/60Hz available upon request.

# Sunmaster IP23 product specifications - 700 - 7200 Wp









gland with PCB spring terminals





	QS1200	QS2000	Q\$3200	QS6400	QS3200 Max-I	QS6400 Max-I	
Article no.	1306×1200	1306x2000	1306x3200	1306x6400	1307x3200	I307×6400	
x = depending on the country-specific version	(see the Mastervolt price list for	the specific country versions and a	rticle numbers)				
GENERAL							
Typical string length	5-9	modules (72 cells), 7-12 modules (	54 cells) or 10-18 modules (36 cells)		4-6 modules (72 cells), 6-9 modules (54 cells)	or 8-12 modules (36 cells)	
Operating temperature	-20 °C to 50 °C, protected again	st high temperatures		-20 °C to 50 °C, protected against high temp	eratures		
Storage temperature	-20 °C to 70 °C			-20 °C to 70 °C			
Relative humidity	max. 95 %; PCB has anti-moistu	re coating		max. 95 %; PCB has anti-moisture coating			
Protection degree	IP23	IP23	IP23	IP23	IP23	IP23	
Safety class	class I	class I	class I	class I	class I	class I	
Galvanic isolation	class II	class II	class II	class II	class II	class II	
Dimensions, hxwxd	340x252x120 mm	340x252x141 mm	462x315x140 mm	476x315x254 mm	462x315x140 mm	476x315x254 mm	
Weight	4.4 kg	6 kg	7 kg	14 kg	7 kg	I4 kg	
SOLAR INPUT (DC)							
Nominal power to 40°C ambient temp.	950 W DC	1700 W DC	2750 W DC	5500 W / 4870 W DC <sup>1)</sup>	2750 W DC	5500 W / 4870 W DC <sup>1)</sup>	
PV power range	700-1200 Wp	1200-2100 Wp	2000-3600 Wp	3200-7200 Wp	2000-3600 Wp	3200-7200 Wp	
Maximum DC power	1100 W	1800 W	2950 W	5900 W	2950 W	5900 W	
MPP Tracker (dynamic) <sup>2)</sup>	I MPP Tracker	I MPP Tracker	2 MPP Trackers	4 MPP Trackers	2 MPP Trackers	4 MPP Trackers	
MPP voltage range	100-380 V DC	100-380 V DC	100-380 V DC	100-380 V DC	75-260 V DC	75-260 V DC	
Maximum voltage	450 V DC	450 V DC	450 V DC	450 V DC	325 V DC	325 V DC	
Nom. rated current	5 A	7.5 A	2x 7.5 A	4x 7.5 A	2x 10 A	4x 10 A	
			or Ix I5 A	or 2x 15 A	or Ix 20 A	or 2x 20 A	
Start-up power (power drawn from the solar side)	2 W	2 W	4 W	8 W	4 W	8 W	
String connections	2	2	2x2	4x2	2×2	4x2	
DC connector	glands + PCB spring terminals 4	mm² max. or Multi Contact connec	ctors	glands + PCB spring terminals 4 mm² max. o	r Multi Contact connectors		
GRID OUTPUT (AC)							
Voltage	230 V (184-265 V, depending on	the model)		230 V (184-265 V, depending on the model)			
	single phase	single phase	single phase	single or double phase	single phase	single or double phase	
Nom. AC power	900 W	1600 W	2600 W	5200W / 4600 W <sup>3)</sup>	2600 W	5200 W / 4600 W <sup>3)</sup>	
Max. AC power	1050 W	1725 W	2750 W	5500W / 4600 W <sup>3)</sup>	2750 W	5500 W / 4600 W <sup>3)</sup>	
Current (fused)	4 A	7 A	12 A	2x I2 A	12 A	2x 12 A	
Frequency	50 Hz (48-52 Hz, depending on	the model)		50 Hz (48-52 Hz, depending on the model)			
Power factor	0.99			0.99			
THD	< 3% @ rated load; in complian	ice with IEEE p929		< 3% @ rated load; in compliance with IEEE p929			
Stand-by power	0 W (DC voltage controlled rela	у)		0 W (DC voltage controlled relay)			
European efficiency	94.5%	94%	94%	94%	94.5%	94.5%	
Maximum efficiency	95%	95%	95%	95%	96%	96%	

<sup>1)</sup> Anti-islanding protection with ENS or QNS; limited to 4870 W DC in case of ENS and one-phase feeding; two-phase feeding with 5500 W DC possible.

gland with PCB spring terminals

AC connector







<sup>2)</sup> Dynamic; two string connections each are connected in parallel.

<sup>3)</sup> Limited to 4600 W AC in case of ENS and one-phase feeding; two-phase feeding with 5200 W AC possible.

#### Manuals

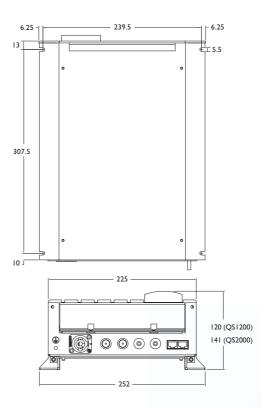
German, French, English, Dutch, Spanish, Italian, Korean.

#### Certificates

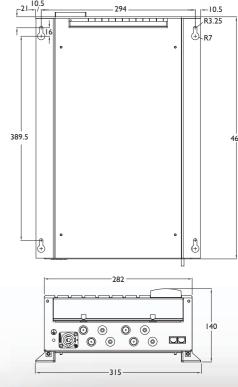
All Sunmaster solar inverters have been approved by local authorities, which is an indispensible guarantee for safe and reliable functioning. The certificates in the Download & Support Area of our www.mastervolt.com website represent some of the documents we have obtained, allowing trouble-free use in the United Kingdom, Germany, the Netherlands, Denmark, the Scandinavian countries, Spain, France, Italy, Greece, Cyprus and Korea.



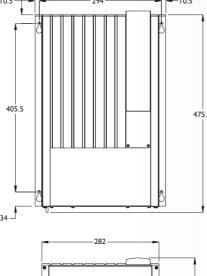
#### **DIMENSIONS IN MM**

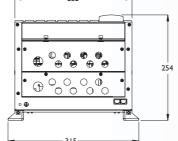


Dimensions QS1200 and QS2000, in mm.



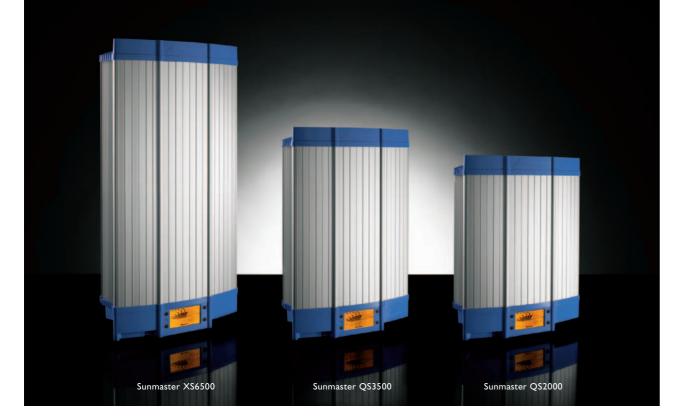
Dimensions QS3200 and QS3200 Max-I, in mm





Dimensions QS6400 and QS6400 Max-I, in mm.





# The new Sunmaster IP44 series: the new generation of compact, easy to install, high performance grid connect inverters from Mastervolt

With the new Sunmaster IP44 series efficiency and optimum power output are guaranteed even in the most arduous of locations. The IP44 waterproof enclosure allows for installation in most protected outdoor areas. Once connected to the PV modules in your system the low weight inverter delivers the power! Both on a bright midsummer day when it's 40° C or more and on a cloudy winter morning. Sometimes even in bright moonlight!

Our world proven HF transformer technology is as ever built in to a compact housing, making installation simple and quick. Integrated heavy duty DC load switching adds to greater safety and simplicity in use - this comes standard on all ENS versions. Mastervolt is proud to offer you yet another innovative product with the introduction of a new and advanced LCD display with miniature data logger - storage of data for up to 30 days - giving you the profitable facts.

No more guesswork.

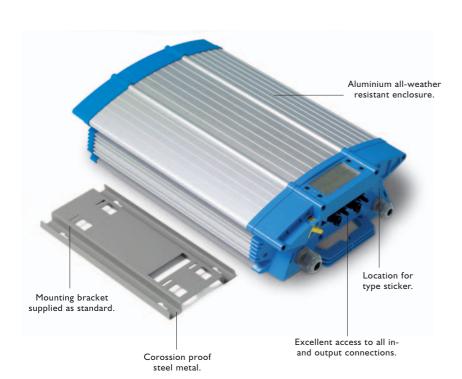
Sunmaster IP44 range (introduction Spring)

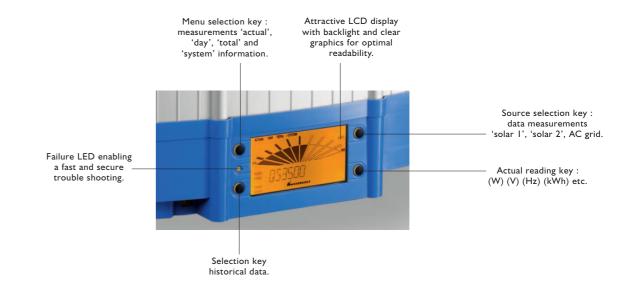
- Sunmaster QS2000;
- Sunmaster QS3500;
- Sunmaster QS3500 Max-I;
- XS6500 offering 5 kW cont. output (introduction medio 2007).

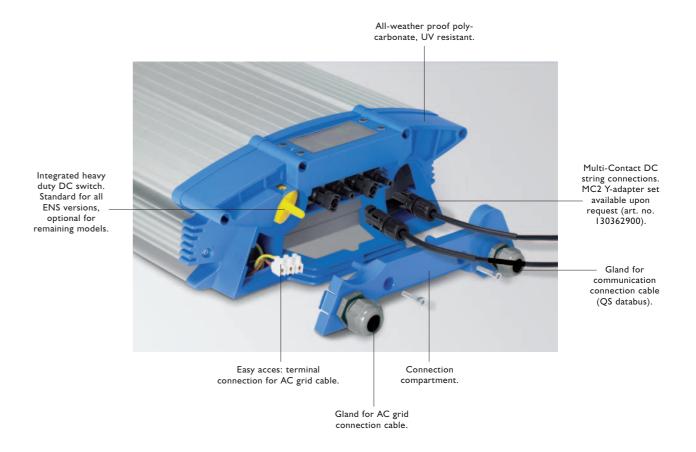


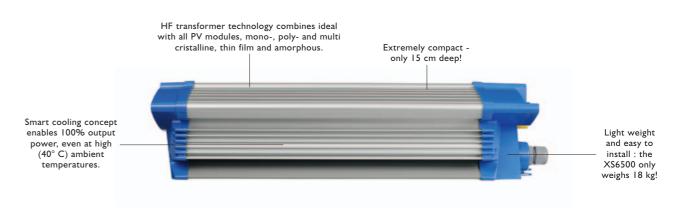
"I have been focused on further integrating the various functions of the Sunmaster grid connected solar inverter. The new Sunmaster IP44 range is the result of this process, with a wider application (now also suitable for protected outdoor use!), user friendliness, smarter connections and a stunning read-out facility. This is one of my best designs so far".

Industrial Designer Rob van Opdorp









# Sunmaster IP44 product specifications

	QS2000	QS3500	QS3500 Max-I	XS6500*
Article number	130852000	130853500	130953500	131056500
GENERAL				
Typical string length	, , ,	7-12 modules (54 cells) or 10 tules (72 cells), 6-9 modules (54 cells)	o 18 modules (36 cells) cells) or 8-12 modules (36 cells)	12-25 modules (36 cells), 7-17 modules (54 cells) or 6-12 modules (72 cells)
Operating temperature			protected against overtemperature	
Storage temperature			20° C to 70° C	
Relative humidity		95 % max	PCB has anti-moisture coating	
Protection degree	IP44	IP44	IP44	IP44
Safety degree	Class I	Class I	Class I	Class I
Galvanic isolation	Class II	Class II	Class II	Class II
Dimensions, HxWxD mm	340×252×141	462x315x140	462x315x140	500×300×150
Weight	6 kg	7 kg	7 kg	18 kg
SOLAR INPUT (DIRECT CURRENT)				
Nominal power 40°C amb. temp	1700 W DC	2750 W DC	2750 W DC	5325 W DC
PV power range	1200-2100 Wp	2000-3600 Wp	2000-3600 Wp	4500-7000 Wp
Maximum output	1800 W	2950 W	2950 W	5600 W
MPP tracker <sup>1)</sup>	I MPP tracker	2 MPP tracker	2 MPP tracker	2 MPP tracker
MPP voltage range	100-380 V DC	100-380 V DC	75-260 V DC	180-480 V DC
Maximum voltage	450 V DC	450 V DC	325 V DC	600 V DC
Nominal rated current	7.5 A	2 x 7.5 A	2 x 10 A	2 x 15 A
		or I x I5 A	or I x 20 A	or I x 30 A
Start-up power	2 W	4 W	4 W	4 W
String connections	1	2x I	2x I	2x I
DC connector		MultiContact connectors	s or glands + PCB spring terminals, 4	4 mm <sup>2</sup>
GRID OUTPUT (INVERTER)				
Voltage	230 V AC (184-265 V,	depending on model)		
	single phase	single phase	single phase	single phase
Nominal output	1600 W	2600 W	2600 W	5000 W / 4600 W for Germany
Maximum output	1725 W	2750 W	2750 W	5250 W / 4600 W for Germany
Nominal current	7 A	12 A	12 A	22 A
Frequency		50 Hz (48-	52 Hz, depending on model)	
Power factor	0.99	0.99		
Harmonic distortion (THD)		< 3% @ rate	d load; in compliance with IEEE	p929
Standby current	0 W	0 W	0 W	0 W
European efficiency	94 %	94 %	94.5 %	94 %
Maximum efficiency	95 %	95 %	95 %	95 %

gland + PCB spring terminals -----

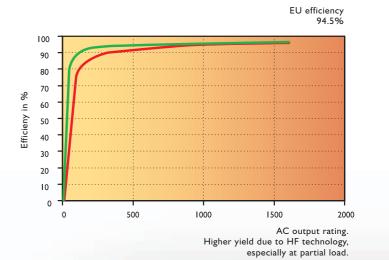
AC connection

I) Dynamic; two string connections each are connected in parallel.



#### Extremely efficient - up to 25% more yield

As a result of the advanced switch mode technology applied, Mastervolt solar inverters have negligible power loss in the DC to AC conversion process, resulting in a much higher AC power return to the grid. Even at 5% of nominal power the inverter realizes more than 90% efficiency. The maximum efficiency is almost 95% which is extremely high considering the input to output galvanic isolation.



Mastervolt inverter.

Other inverter.



<sup>\*</sup> Available from Summer 2007.

## Sunmaster IP44 product specifications

SAFETY DEVICES	
General	galvanic separation between DC and AC side,
	by means of a class II HF transformer
Island protection	ENS models : redundant impedance, voltage and frequency window monitoring;
	independent switch off by two pole relay and solid state switch;
	VDE V 0126-1-1:2006 compliant.
	<ul> <li>QNS models: redundant voltage and frequency window monitoring;</li> </ul>
	independent switch off by two pole relay and solid state switch.
	<ul> <li>UK models: software-controlled frequency adjustment according to G83.</li> </ul>
Temperature protection	power derating at Tambient > 40° C;
	switch off at $T_{indoor} > 90^{\circ} C$
DC side protection	earth fault detection
	over-voltage detection
	polarity protection (diodes)
	current limitation
	transients (varistor and buffer capacitor)
	overload (temperature controlled power derating)
AC side protection	current limitation
	over and undervoltage
	over and underfrequency
	short circuit (ceramic fuse)
	• transients / surge (varistors)
Reclosure time	I 0-300s (model dependent)
MONITORING	
On the front	integrated LCD display
External communication	two RS485 connections to connect to the QS databus
Optional monitoring accessories	Data Control Basic: software for PC
	QS PC-Link: PC adapter for QS data bus
	Data Control Premium II: data logger and PC local/remote monitoring/
	Internet connection
	Data Control Professional : data logger and PC local/remote monitoring/Internet
	connection using current weather data or optional sensors
REGULATIONS & DIRECTIVES	
CE conformity	yes
EMC directive	EMC 89/336/EEC
Emission	EN 50081-1, EN 55011, EN 55014, EN 55022, VDE 0871 class B
Harmonics	EN 61000-3-2, IEEEp929, Flicker:61000-3-3
Immunity	EN 50082-2
,	
LV directive	73/23/EEC



#### Mastervolt Guarantee Plan • 5-year product warranty • worldwide service • 48-hour replacement service

# Extended monitoring as standard

The Mastervolt communication modules offer a flexible, reliable and user-friendly possibility to permanently monitor your gridconnected photovoltaic system, also from a remote location. This ensures a constant overview of the solar power yield and all important system data. When a value is no longer within the specified limits, you can quickly take corrective actions. External energy counters are not required. The modules Data Control Basic, Data Control Premium II and Data Control Pro offer different functional possibilities extending from the display of the current systems data on the optional display to the web-based remote monitoring and visualisation.

#### **Data Control Basic** (standard for the IP23 and IP44 range)

Every Sunmaster model comes as standard with an integrated RS485 communication interface and a ten-day power output memory. This makes the entire PV system interactive, with the option of reading the most essential information using your PC or laptop. All that is required to connect the Sunmaster with your computer is a communication cable and PC link (adapter plug).

> Basic monitoring via the PC, Data Control Basic-Software

The software for reading out the data under Microsoft Windows is available free of charge in the Download & Support section of our website under www.mastervolt.com.

The Data Control Basic programme gives a schematic overview of the PV system's performance, including:

- Power and operational hours over a ten-day period.
- Voltage, current and load of the solar panels (current values).
- Voltage, current and frequency of the 230 V grid (current
- Internal temperature, total power (kWh), total hours of operation.
- Read out of the number of returned amperes (output side).
- Grid voltage, current and frequency (output side).
- Read out of the temperature of the Sunmaster, total output in kWh, status of operational hours.
- · Current status and error messages.











PC-Link (optional), article no. 130391010.





## Data monitoring: Data Control Premium II

As a follow-up to the successful 'Premium' model for mediumsized systems, the new Premium II offers numerous new functions and an extended operating range. Based on the Data Control Professional concept, it provides a functional scope previously only found in extremely large systems. Professional quality at a reasonable price: A unique offer!

#### Versions

Two Premium II versions are available for different fields of applications.

**Premium II Local** with incorporated Ethernet (network) interface.

#### Applications:

- Data transmission to PC/port, directly or via network/ evaluation via Premium II PC software.
- Data transmission via internet with the existing ADSL connection/evaluation via the Mastervolt portal.

Premium II Remote with integrated analogue modem.

#### Applications:

- Remote data transmission to PC, evaluation via Premium II PC software.
- Remote data transmission via the Mastervolt server, evaluation via the Mastervolt portal.

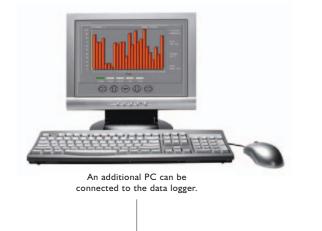
#### Interface

All inputs and outputs you may wish for are included as standard:

- QS Databus interface for six QS inverters or 30 kW maximum.
- Analogue input (0-10V) for irradiation sensor (Mastervolt temperature-compensated sensor available as option).
- Digital input for kWh counter.
- Digital output for alarm connection or large-size display.
- Integrated power pack.
- Ethernet port (Premium II Local).
- Telephone connection for integrated analogue model (Premium II Remote).

#### Data registration

A QS data interface connects all inverters with the Premium II data registration unit. Up to six inverters can be connected. The Premium II data logger continuously communicates with all connected inverters and saves all current measured values and system data every 10 minutes. The device offers a large data memory for values measured over a period of up to three years (depending on the configuration).





The collected data is sent to the internet.





#### **Specifications Data Control Premium II**

Data registration module for Sunmaster QS and XS systems.





Premium II Local (Ethernet)

Premium II Remote (Modem)

Article number	130396000	130396100
HOUSING		
Dimensions (LxWxH)	70×90×77 mm (6 TE)	70x90x77 mm (6 TE)
Installation	hat rails	hat rails
Mode of protection	IP20	IP20
Temperature range	0 - 55° C	0 - 55° C
VOLTAGE SUPPLY		
Power pack 230 V	internal	internal
Voltage supply (sensors)	yes, 24 V	yes, 24 V
INPUTS / OUTPUTS		
Analogue (irradiation)	I	I
Digital (kWh counter)	I	ı
Outputs (alarm, large-size display)	I	I
INTERFACES / COMMUNICATION		
RS485 (QS Databus)	I (6 WR / 30 kW)	I (6WR / 30 kW)
Ethernet (network / PC)	I .	
Modem (analogue)		1
DATA READOUT		
Internet portal	no	yes
PC software	yes	yes
ALARM FUNCTION		
E-mail (via network)	yes	yes
SMS	no	yes
Fax	no	yes
Visual	yes	yes
Acoustic	option	option

#### Recorded values

In addition to energy, irradiation and operating hours numerous additional measured values are recorded:

- Energy yield and operating hours.
- Total energy yield and total operating hours (since commissioning).
- Voltage, current and power output of the connected solar modules.
- Voltage, current, frequency and impedance of the 230 V mains.
- Current internal temperature of the inverter.
- $\bullet\,$  Power currently supplied to the mains
- Serial number, communication address, inverter number.
- Current status and fault messages (e.g. overvoltage, ENS switch off, over-temperature).

The cause of any failure can be easily determined and the fault remedied with the additional operating data. With Premium II

Remote, installers can dial in via an internet or modem connection and assess in advance what has to be done.

#### **Evaluation**

Data inquiry and evaluation is via a PC. The connection to the Data Control Premium II Local is optionally established via direct or network connection. The Premium II Remote can be optionally evaluated via the data telecommunication (modem) connection or worldwide via the Mastervolt Internet Portal. Five years free access to the Mastervolt Internet Portal is included in the price. There is only an initial charge payable for setting up your system in the portal.

#### Monitoring/alarm function

Email, fax, SMS, visual, acoustic (optional).

The connected inverters are automatically detected.







# Internet data monitoring: Data Control Pro

The Data Control Professional data logger provides monitoring, read outs and alarm warnings via the internet. During the day, the data logger extracts information on power output directly from up to 20 Sunmaster inverters via the QS data port. This eliminates the need for external kWh meters. Overnight, the collected data is sent to a web page, from which it can later be accessed from anywhere in the world using a log in code. Exceptionally accurate weather prediction data is used to assess the output of the PV system. An important advantage of the system is the link from the local monitoring to the weather registration of Meteomedia in Germany. An external reference cell is not required.

Should the Sunmaster inverters report a system fault or the solar yield not conform to the expected specified value, an alarm routine of the Safer Sun Programme is activated. According to the settings, an alarm is triggered on site at the device itself or a warning message is sent by email, fax or SMS. This superior monitoring method ensures a high availability of the recording device, which in turn enables a large number of systems to be monitored.

#### **Data Control Pro specifications**

Integrated modem	analogue	ISDN	GSM				
	+ -						
Art. no. 1303.96.2xx	xx = 00	xx = 10	xx = 20				
Interfaces							
Input analogue	4 (0-20 mA	, 0-10V)					
Input digital	4 (meters /	status)					
Bus connection	I (RS485)						
Internet connection	Ethernet	Ethernet					
Alarm output	24 V DC /	24 V DC / 230 V AC, 2					
Electrical data							
Grid connection	230 V AC						
Power	2 W (max.)						
Mechanical data							
Dimensions	105 x 90 x	77 mm (wxh	xd)				
Mounting	hat rail mounting						
Protection degree	IP20						
Environmental condition	ns						
Operating temp.	0 to 55° C						
Storage temp.	-20 to 65°	С					
Data logger		all current measured values and system data of the inverters					

Miniature web server

Data recording and evaluation with Safer'Sun:

- Automatic daily data recording with high resolution
- Evaluation per day, month and year
- Graphic data display
- Alarm messages via fax, SMS, email
- Automatic comparison with the actual, regional irradiance data
- Worldwide access through the Internet







Data Control Pro 230 V - GSM modem,

## Accessories Data Monitoring

#### **Data Control Basic**



PC-Link art. no. 130391010.



Model RS485/USB ISO, art. no. 130391040.



Model RS485/232 converter, art. no. 130391020.

PC-Link Industrial, for the connection of more than 10 Sunmasters or 25 mtr connection cable.

#### **Data Control Premium II & Data Control Pro**



DC Pro irradiation sensor 0-10V. temp. compensated, art. no. 130394300.



DC Pro irradiation and temperature sensor 0-10V. art. no. 130394400.



Data Control Pro 230V-ISDN in enclosure, art. no. 130396310.



DC Pro ambient temperature sensor 0-10 V. art. no. 130394420.



Documentation CD Data Control Pro, includes user manual, installation information and drawings.



PT100 converter. art. no. 130394440.



## DC switch off for PV systems

#### DC solar switch : DC isolating boxes

The international standard IEC60364-7-712 prescribes a DC switch in solar electric installations on buildings. The introduction of this standard means a safety improvement for installation and service personnel.

The requirements for these DC switches are quite specific because of the direct current coming from the Photovoltaic modules. Santon switches selected by Mastervolt have a unique construction, making them especially suitable for switching direct current. Compliance with EN 60947-3, which specifies the switching speed, is a major advantage since it ensures safety and a long life time. The utilization category DC-21A makes it the perfect choice for use in PV installations.

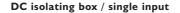
The Santon switch will be integrated into QS and XS IP44 products.

External isolation boxes are available for existing QS 'Indoor' products. Single and double output types are available rated 600 V and 25 A. Since Mastervolt solar inverters have an integrated overvoltage protection on the DC input, a surge protection in the DC isolating box is not needed. The boxes are designed for use with up to 4 strings. The double output type can be extended to 8 strings by adding glands.

Both boxes have IP65 protection and are TüV and KEMA certified

#### Technical specifications







DC isolating box / dual input

Article no.	130346000	130347000
Power rating	600 V / 25 A	2x 600 V / 25 A
Connections	4 string connections	4 string (extendable to 8 by adding glands)
	I output to inverter	2 outputs to inverter MPP
Mounting	DIN rail in IP65 rugged plastic housing	DIN rail in IP65 rugged plastic housing
Safety class	II	II
Ambient condition	20 °C to 70 °C	20 °C to 70 °C
Max. wire diameter	4 mm <sup>2</sup>	4 mm <sup>2</sup>
Dimensions, hxwxd.	180x180x145 mm	180×254×145 mm
Applications	QS1200, QS2000	QS3200, QS3200 Max-I
	QS3200 (parallel inputs)	QS6000 (2x 15A input)*
	QS3200 Max-I (parallel inputs)	QS6400 Max-I (2x 20A input)*

 $<sup>\</sup>ensuremath{^{*}}$  Use two dual input switches for QS6400 4-input configuration.

## New Sunmaster XL series for high power PV systems



The most recent development is a new high power solar inverter with a power rating between 7.5 and 15 kW AC. We are offering three different models with power ratings of 7.5 kWp, 10 kWp and 15 kWp.

The new Sunmaster XL models are delivered in a waterproof IP54 enclosure which can be installed in either a grid connected solar tracker system or a stationary PV system. The inverter consists of three highly efficient switch mode power modules of 2.5, 3.5 or 5 kW power rating each, dependent on the model. The unit has an operating DC voltage window of 100-450 V DC (QS models) or 100-600 V DC (XS models). Galvanic isolation is provided by class II high frequency transformers.

Mastervolt claims a system efficiency of over 95 % (EU). The output voltage is 230 V AC three-phase, 50 Hz. Islanding protection is foreseen according to local standards. Extended diagnostics and remote monitoring is delivered as a standard.

Dimensions for all models (hxwxd)  $1200 \times 700 \times 504$  mm, weight 80 kg excl. module. Availability: July 2007.

Detailed specifications are available on request.







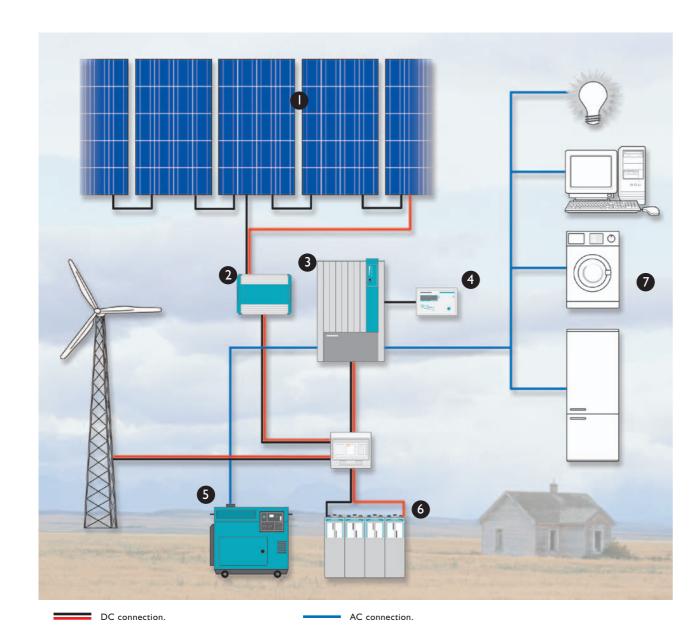


#### Electrical power systems for absolute independence

Solar modules are eminently suitable as a source of energy also in areas where the electricity network is unreliable or nonexistent. Any extra power generated is stored in an energy buffer - the battery - and the optional monitoring system helps keep track of power consumption.

Mastervolt offers a wide range of sine wave inverters and combis that convert raw electricity generated by PV or wind generators into a clean and stable, universally applicable AC voltage. Mastervolt inverters and combis deliver 230 V/50 Hz or 120 V/60 Hz sine wave power for lamps, refrigerators, computers, tools, water pumps and various other appliances.

Dakar and Mass Combi models incorporate an advanced threestage battery charger for use on cloudy days by connecting a small diesel or petrol generator. This system guarantees you genuine independence from the electricity company and ensures a high quality power supply.



#### Equipment needed for autonomous, grid independent systems:

- I. Solar modules (not provided by Mastervolt).
- 2. Battery charge regulator with MPP tracker.
- 3. Mastervolt sine wave inverter/charger (e.g. Mass Combi).
- 4. System monitoring.

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5. Back-up generator.

- Mastervolt deep cycle batteries for power storage (AGM or gel).
- Energy consumers in the house (not provided by Mastervolt).



Mass Combi inverter/charger models.

# The best choice for autonomous PV systems

Mastervolt offers a wide range of highly efficient sine wave inverters and inverter/charger combinations, ranging from 250 W to 15 kW. In this brochure we have listed our Mass Sine standalone solar inverter, Mass Combi inverter/charger and the recently upgraded Dakar Combi series. All product ranges are designed to operate in harsh environments with high ambient temperatures. We also highlight our maintenance-free lead batteries and battery chargers, which are ideal for quickly and completely charging the batteries using a diesel or petrol generator.

# Mastervolt Combi: Combination of functionalities

- Conversion of battery power to 230 V/50 Hz or 120 V/60 Hz sine wave power.
- Battery charging in case generator or utility power is available.
- Automatic load switching from generator or utility to inverter.
- Programmable: all system variations can be selected by MasterAdjust software.
- Energy management by means of advanced monitoring through remote panel and/or PC.
- Can be stacked to double the power.

#### eatures:

- Switch mode technology (Mass models).
- Extremely efficient and minimal heat loss.
- · Exceptionally quiet.
- Easy to mount in a central IP54 or IP65 cabinet.
- High peak power (200%) offered by a build-in soft start to handle inductive loads smoothly.
- Pure sine wave output under all load circumstances.
- Power factor corrected battery charger: accepts almost any type of generator (Mass Combi models).
- Three-step Plus charge method ensures the fastest and most complete recharge.

#### Complete range:

- $\bullet\,$  Output capacity ranging from 250 W to 15 kW.
- Available for both 230 V/50 Hz and 120 V/60 Hz.
- $\bullet$  Available in 12, 24 and 48 V DC.
- · Perfectly compatible with existing systems.
- Pure sine wave output: protection of your appliances and trouble-free operation.
- Simple and extremely safe installation.
- Available as complete system, including batteries.





# Overview sine wave inverters - AC Master range

				No.			No.	
	12/200	12/350	12/700*	12/1200*	24/200	24/350	24/700*	24/1200*
	AC Master	AC Master	AC Master	AC Master	AC Master	AC Master	AC Master	AC Master
Article no. 230 V	28010200	28010350	28010700	28011200	28020200	28020350	28020700	28021200
Article no. 120 V	n.a.	28520350	28510700	28512000	n.a.	n.a.	28520700	n.a.
GENERAL SPECIFICATIONS								
Nom. battery voltage	12 V	12 V	12 V	12 V	24 V	24 V	24 V	24 V
P30 power Tamb= 40° C, cos phi I	200 VA	350 VA	700 VA	1200 VA	200 VA	350 VA	700 VA	1200 VA
Max. peak load	400 VA	700 VA	1400 VA	2400 VA	400 VA	700 VA	1400 VA	2400 VA
Output waveform	true sine	true sine	true sine	true sine	true sine	true sine	true sine	true sine
Max. efficiency	90 %	86 %	91 %	90 %	93 %	89 %	93 %	93 %
Output voltage	230 V, ± 5 %	230 V, ± 5 %	230 V, ± 5 %	230 V, ± 5 %	230 V, ± 5 %	230 V, ± 5 %	230 V, ± 5 %	230 V, ± 5 %
Frequence	50/60 Hz, ± 0.03 Hz	2		50/60 Hz, ± 0.03 Hz	2			
Dimensions (hxwxd) in mm	74×152×242	74x152x242	76x180x295	upon request	74×152×242	74×152×242	76×180×295	upon request
Weight	1.65 kg	1.85 kg	2.7 kg	7 kg	1.65 kg	1.85 kg	2.7 kg	7 kg
Protection degree	IP21	IP21	IP21	IP21	IP2 I	IP21	IP21	IP21
Min. battery capacity	>50 Ah	>80 Ah	>100 Ah	>150 Ah	>25 Ah	>40 Ah	>50 Ah	>100 Ah
TECHNICAL SPECIFICATIONS								
Technology	HF / Switch mode (2	5 kHz)		HF / Switch mode (2	5 kHz)			
Switch off voltage low battery	10.3 V, ±0.5 V	10.3 V, ±0.5 V	10.3 V, ±0.5 V	10.3 V, ±0.5 V	20.6 V, ±0.5 V	20.6 V, ±0.5 V	20.6 V, ±0.5 V	20.6 V, ±0.5 V
Switch on voltage low battery	12.3 V, ±0.5 V	12.3 V, ±0.5 V	12.3 V, ±0.5 V	12.3 V, ±0.5 V	24.6 V, ±0.5 V	24.6 V, ±0.5 V	24.6 V, ±0.5 V	24.6 V, ±0.5 V
Switch off voltage high battery	15.3 V, ±0.5 V	15.3 V, ±0.5 V	15.3 V, ±0.5 V	15.3 V, ±0.5 V	30.6 V, ±0.5 V	30.6 V, ±0.5 V	30.6 V, ±0.5 V	30.6 V, ±0.5 V
Switch on voltage high battery	14.6 V, ±0.5 V	14.6 V, ±0.5 V	14.6 V, ±0.5 V	14.6 V, ±0.5 V	29.2 V, ±0.5 V	29.2 V, ±0.5 V	29.2 V, ±0.5 V	29.2 V, ±0.5 V
Max. allowable riple on DC	5 % RMS	5 % RMS	5 % RMS	5 % RMS	5 % RMS	5 % RMS	5 % RMS	5 % RMS
Input current (nom. load)	23 A	38 A	76 A	110 A	15 A	25 A	32 A	55 A
No load power consumption :								
Off mode	0 mA	0 mA	0 mA	0 mA	0 mA	0 mA	0 mA	0 mA
• stand-by mode	0.8 A/9.6 W	0.8 A/9.6 W	1.2 A/14.4 W	1.4 A/16.8 W	0.5 A/12 W	0.5 A/12 W	0.6 A/14.4 W	0.7 A/16.8 W
DC fuse required (slow blow)	30 A	40 A	80 A	160 A	20 A	30 A	40 A	80 A
Min. DC cable size	supplied	supplied	supplied	supplied	supplied	supplied	supplied	supplied
Harmonic distortion typical	3 %	3 %	3 %	3 %	3 %	3 %	3 %	3 %
Cooling		conventional / forced				conventional / forced -		
AC connection (single phase, 3-wire)	cor	ntinental European socket C	EE-7/7		con	tinental European socket Cl	EE-7/7	
Cos Phi		all power factors allowed				all power factors allowed		
Operating temperature specified	full spec 0° C to 40°	C, ambient temperature 40°	°C to 60°C, derating with	5 % /°C. Shutdown at 80°	C heat sink temperature.			
(will meet specified tolerances)								
Practical operating temperature	-25° C to 40° C amb	ient temperature, 40° C to 6	60° C derating with 5 %/ °C.	Shutdown at 80° C heat si	nk temperature.			
(may not meet specified tolerances)								
Relative humidity	protected against hu	midity and condensing air by	conformal coating on both side	es of all PCB's. Max. 95 % rela	ative humidity, none conden	sing.		
Standard and Approvals	CE, E-marking	, , , , , ,	<u> </u>		,			
11 *****	,							

<sup>\*</sup> Available from Autumn 2007. Standardly equipped with Automatic Transfer Switch (built-in), utility power - inverter - vehicle system.









<sup>\*\*</sup> The 230V models are standard equipped with a continental European socket CEE7/7 as printed below. The 120V models with the standard US socket NEMA 5-15. Optionally (volume dependent): we can deliver the inverters also with an IEC-I socket or a cable gland/hardwiring connection.

# Overview sine wave inverters - Mass Sine range

	12/500*	12/800	12/1200	12/2000	24/800	24/1500	24/2500*	24/5000	24/10kVA
	Mass Sine	Mass Sine	Mass Sine	Mass Sine	Mass Sine	Mass Sine	Mass Sine	Mass Sine	Mass Sine
Article no. 230 V	26010510	24010800	24011200	24012000	24020800	24021500	24022500	24095100	24026000
Article no. 120 V**	27010510	n.a.	25011000	25012000	n.a.	25021000	25022500	25024000	n.a.
GENERAL SPECIFICATIONS									
Nominal battery voltage	12 V	12 V	12 V	12 V	24 V	24 V	24 V	24 V	24 V
P30 power Tamb= 25° C, cos phi I	500 VA	800 VA	1200 VA	2000 VA	800 VA	1500 VA	2500 VA	5000 VA	I0 kVA
Nom. power Tamb= 40° C, cos phi I	450 VA	650 VA	1000 VA	1800 VA	650 VA	1200 VA	2000 VA	4000 VA	8 kVA
Maximal peak load	1000 VA	1600 VA	2400 VA	4000 VA	1600 VA	2900 VA	5000 VA	10000 VA	20 kVA
Output waveform	true sine	true sine	true sine	true sine	true sine	true sine	true sine	true sine	true sine
Max. efficiency	91%	92%	92%	92%	92%	92%	92%	90%	92%
Output voltage	230 V, ± 5%	230 V, ± 5%	230 V, ± 5%	230 V, ± 5%	230 V, ± 5%	230 V, ± 5%	230 V, ± 5%	230 V, ± 5%	230 V, ± 5%
Frequency	50 Hz, ± 0.05 Hz			50 Hz, ± 0.05 Hz			all models of 2.5 kV	A and more can be adj	usted to 60 Hz
Dimensions, hxwxd in mm	313x187x82	325x220x111	340×261×130	420x318x130	325x220x111	340×261×130	420x318x130	475.5x318x254	2xC4 + C5
Weight	3.4 kg	3.9 kg	6 kg	9.4 kg	3.9 kg	6 kg	9.7 kg	19 kg	44 kg
Minimum battery capacity	>100 Ah	>100 Ah	> I 50 Ah	>200 Ah	>50 Ah	>150 Ah	>200 Ah	>400 Ah	>500 Ah
OPTIONS									
Model C4-RI (art. no. 70404110)	yes	yes	yes	yes	yes	yes	yes	yes	yes
Masterlink/MICC (art. no. 70403105)	yes	yes	yes	yes	yes	yes	yes	yes	yes
System Manager MICC (art. no. 70400115)	yes	yes	yes	yes	yes	yes	yes	yes	yes
Universal connection cables for the remote controls	(please state when order	ing): • 6 metre - art. no.	6502001030 / • 10 metre - art. no. 6502	100100 / • 15 metre	- art. no. 6502100150				
Transfer system	the Masterswitch and	Systemswitch can be conn	ected to all inverters	the Masterswitch a	nd Systemswitch can be	connected to all inver	ters		
TECHNICAL SPECIFICATIONS									
Technology	HF	HF	HF	HF	HF	HF	HF	HF	HF
Switch off voltage low battery	10.5 V, ±0.5 V	10 V, ±0.5 V	10 V, ±0.5 V	10 V, ±0.5 V	19 V, ±0.5 V	19 V, ±0.5 V	19 V, ±0.5 V	19 V, ±0.5 V	19 V, ±0.5 V
Switch on voltage low battery	II V, ±0.5 V	II V, ±0.5 V	II V, ±0.5 V	II V, ±0.5 V	22 V, ±0.5 V	22 V, ±0.5 V	22 V, ±0.5 V	22 V, ±0.5 V	22 V, ±0.5 V
Switch off voltage high battery	16 V, ±1 V	16 V, ±1 V	15.5 V, ±0.5 V	15.5 V, ±0.5 V	31 V, ±0.5 V	33 V, ±0.5 V	33 V, ±0.5 V	33 V, ±0.5 V	32 V, ±0.5 V
Switch on voltage high battery	14.5 V, ±1 V	14.5 V, ±0.5 V	14.5 V, ±0.5 V	14.5 V, $\pm 0.5$ V	30 V, $\pm 0.5$ V	31 V, ±0.5 V	31 V, ±0.5 V	31 V, ±0.5 V	31 V, ±0.5 V
Max. allowable ripple on DC	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS
Input current (nominal load)	23 A	38 A	42A	68 A	34 A	70 A	120 A	240 A	4x 120 A
No load power consumption:									
• off mode	0 mA	0 mA	0 mA	0 mA	0 mA	0 mA	0 mA	0 mA	0 mA
• stand-by mode	43 mA/0.5 W	65 mA/0.8 W	43 mA/0.5 W	50 mA/0.6 W	35 mA/0.8 W	25 mA/0.6 W	25 mA/0.6 W	n.a.	< 10 W, 412 mA
• 'low energy' mode (208 V)	300 mA3.6 W	420 mA/4.9 W	420 mA/5 W	420 mA/5 W	200 mA/4.9 W	180 mA/4.5 W	225 mA/5.4 W	n.a.	n.a.
• 'high power' mode (230 V)	325 A/3.9 W	470 A/5.6 W	450 mA/5 W	480 mA/6 W	240 mA/5.6 W	200 A/5 W	250 A/6 W	250 mA/6 W	150 W
DC fuse required (slow blow)	100 A	100 A	120 A	240 A	63 A	100 A	160 A	2×160 A	4x 160 A
Minimum DC cable size	6 mm <sup>2</sup>	25 mm²	50 mm²	70 mm²	16 mm²	25 mm <sup>2</sup>	50 mm <sup>2</sup>	2x 50 mm <sup>2</sup>	4x 50 mm²
Harmonic distortion typical				30/	20/	20/	30/	20/	2.50/
· · · · · · · · · · · · · · · · · · ·	3%	3%	3%	3%	3%	3%	3%	3%	2.5%
Cooling			3% 	3%	3%		3% nal/forced		2.5%
···					internal				internal

<sup>\*</sup> Also available for 48 V, art. no. 48/500: 24040500 / art. no. 48/2500: 24042500.













<sup>\*\* 15%</sup> load reduction for the 120 V/60 Hz models.

# Mass Combi & Dakar Combi series











#### Mastervolt Guarantee Plan















V)	
.5 A	





0		
System	n failure	Inver
		1,250
	3	19

• 2-year product warranty • worldwide service	
• Mastervolt 3-sten charging method	

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bi	Mas

mbi	Mas

U.B.	
mbi	Mass Co
60	24/4000

	12/1200-60	12/2000-100	12/4000-200	24/1200-35	24/2000-60	24/4000-120	48/5000-60
Article no. 230 V	36011205	36012005	36014005	36021205	36022005	36024005	31845000
Article no. 120 V	n.a.	37012005	37014005	n.a.	37022005	37024005	n.a.
SINE WAVE INVERTER - SPECIFICATIONS							
DC input voltage (nominal)	12 V (10-15 V)	12 V (10-15 V)	12 V (10-15 V)	24 V (20-31 V)	24 V (20-31 V)	24 V (20-32 V)	48 V (40-60 V)
Continuous power @ 25° C	1200 VA / 5.3 A	2000 VA / 8.7 A	3750 VA / 16.5 A	1200 VA / 5.3 A	2000 VA / 8.7 A	3750 VA / 16.5 A	4500 VA / 19.5 A
Surge capability (5 sec., resistive)	2400 VA / 10.5 A	4000 VA / 17.5 A	7500 VA / 32 A	2400 VA / 10.5 A	4000 VA / 17.5 A	7500 VA / 32 A	10.000 VA
Parallel use (to double the power)	no	yes	no	no	yes	no	no
Parallel with shore/generator (for more power)	yes	yes	upon request	yes	yes	upon request	no
Output voltage, adjustable via MasterAdjust software	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%
Frequency (nominal ± 0.05% crystal controlled)	50-60 Hz adjustable	50-60 Hz adjustable	50-60 Hz adjustable	50-60 Hz adjustable	50-60 Hz adjustable	50-60 Hz adjustable	50-60 Hz adjustable
Output waveform	true sine wave	true sine wave	true sine wave	true sine wave	true sine wave	true sine wave	true sine wave
Max. efficiency	92%	92%	92%	92%	92%	92%	90%
No load consumption 230 V	< 9 W	< 9 W	< 18 W	< 9 W	< 9 W	< 18 W	4.8 W
Search mode consumption + setting range	0.5 W - 40/150 VA	I W - 40/150 VA	0.5 W - 40/150 VA	0.5 W - 40/150 VA	0.5 W - 40/150 VA	I W - 40/I50 VA	n.a.
Enclosure type and dimensions (hxwxd in mm)	C3A, 371x318x143	C4, 460.5x318x143	C5, 460.5x318x266	C3A, 371x318x143	C4, 460.5x318x143	C5, 460.5x318x266	D4, 530x363x253
Weight	7.8 kg	II kg	21 kg	7.8 kg	II kg	21 kg	47 kg
AUTOMATIC BATTERY CHARGER - SPECIFICATION	S						
Input voltage nominal	230 V (180-265 V)	230 V (180-265 V)	230 V (180-265 V)	230 V (180-265 V)	230 V (180-250 V)	230 V (180-250 V)	230 V (180-250 V)
Frequency	45-65 Hz	45-65 Hz	45-65 Hz	45-65 Hz	45-66 Hz	45-66 Hz	45-66 Hz
Max. charge rate (adjustable)	60 A, at 14.25 V DC	100 A, at 14.25 V DC	200 A, at 14.25 V DC	35 A, 28.5 V DC	60 A, at 28.5 V DC	120 A, at 28.5 V DC	60 A, at 48 V DC
Primary AC consumption (full charge)	1000 VA / 4.4 A	1635 VA / 7.2 A	3270 VA / 14.4 A	1170 VA / 5.1 A	1965 VA / 8.5 A	3900 VA / 17 A	3950 VA / 17.2 A
Charge voltage 25° C	14.25/13.25 V	14.25/13.25 V	14.25/13.25 V	28.5/26.5 V	28.5/26.5 V	28.5/26.5 V	57/53 V
Battery type settings	open lead / gel / traction	/ AGM / spiral		open lead / gel / traction / A	GM / spiral		
Second charge output, 3-stage	5 A	5 A	2x 5 A	5 A	5 A	2x 5 A	3 A
Charge characteristic	IUoUo 3-stage (bulk, abs	sorption, float), temp. comp	ensation -5mV/cell/°C	IUoUo 3-stage (bulk, absorp	tion, float), temp. compensation	n -5mV/cell/°C	
Voltage sense function	yes, automatic	yes, automatic	yes, automatic	yes, automatic	yes, automatic	yes, automatic	yes, two sense wires
Temperature sensor battery	6 metre cable and telejac	ck plug delivered as standard	1	6 metre cable and telejack p	lug delivered as standard		
DOUBLE POLE TRANSFER SYSTEM							
Max. current first/generator output	50 A	50 A	50 A	50 A	50 A	50 A	n.a.
Max. current short break/inverter output	25 A	25 A	25 A	25 A	25 A	25 A	25 A
Transfer rate	10 ms	10 ms	10 ms	10 ms	I0 ms	I0 ms	10 ms
GENERAL SPECIFICATIONS							
Harmonic distortion (typical)	< 5%	< 5%	< 5%	< 5%	< 5%	< 5%	< 5%
Temperature range	according specifications:	0-25°C, thereafter derating			according specifications: 0-2	25°C, thereafter derating	
Grounding	ac	ljustable by DIP switch			adjustable by DIP switch		optional, specify when ordering
Forced air cooling	mai	ntenance free vario fans			maintenance fr	ee vario fans	
Listings	fully CE and E-marking ac	cording Automotive Directiv	e 95/54/EC (12/4000-200 & 24/4000	-120 E-mark is pending)			fully CE compliant
REMOTE CONTROL AND MONITORING							
Remote panel ICC (art. no. 70405000)		th 6 metre cable for the 2 ar	· · · · · · · · · · · · · · · · · · ·	I for the I200 models			Centre Control (art. no. 55002045)
Remote APC (art. no. 70405010)	optional	optional	optional	optional	optional	optional	n.a.
Masterlink/MICC (art. no. 70403105)	optional	optional	optional	optional	optional	optional	n.a.

# Overview battery chargers - IVO & Mass range

	IVO Smart 12/10 - IP65	IVO Compact I2/25-3	IVO Smart 24/6 - IP65	Mass 24/50-2	Mass 24/100-C	Mass 24/100-3ph	Mass 48/25	Mass 48/50
Article no.	43011000	43012500	43020600	40020500	40021005	40031000	40040250	40040500
GENERAL SPECIFICATIONS								
Nominal input voltage	230 V (180-250V)	120/230 V (auto*)	230 V (180-250 V)	230 V (180-250 V)	230 V (180-250 V)	3x400 V (360-485 V)	230 V (180-250 V)	230 V (180-250 V)
Nominal output voltage	12 V	12 V	24 V	24 V	24 V	24 V	48 V	48 V
Total charge current	10 A	25 A	6 A	50 A	100 A	100 A	25 A	50 A
Number of battery outlets	1	3	1	2	1	1	I	1
Charge current second + third output	n.a.	25 A + 3 A	n.a.	3 A	optional 3 A	optional 3 A	n.a.	n.a.
Charge characteristic	IUoUo, automatic / 3	-step⊕		IUoUo, automatic / 3-s	step <sup>⊕</sup>			
Charge voltage Bulk (25° C)	14.40 V	14.40 V	28.80 V	28.50 V	28.50 V	28.50 V	57.0 V	57.0 V
Charge voltage Absorption (25° C)	14.25 V	14.25 V	28.50 V	28.50 V	28.50 V	28.50 V	57.0 V	57.0 V
Charge voltage Float - wet (25° C)	13.25 V	13.25 V	26.50 V	26.50 V	26.50 V	26.50 V	53.0 V	53.0 V
Charge voltage Float - gel/AGM (25° C)	13.80 V	13.80 V	27.60 V	27.60 V	27.60 V	27.60 V	55.2 V	55.2 V
Max. absorption time	6 hours	6 hours	6 hours	6 hours	6 hours	6 hours	6 hours	6 hours
Min. absorption time	15 min.	I5 min.	I5 min.	5 min.	15 min.	I5 min.	15 min.	15 min.
Dimensions (hxwxd in mm)	180×121×50	228×153×82	180x121x50	C2, 340x261x130	C3, 420x318x130	C3, 420x318x130	C2, 340x261x130	C3, 420x318x130
Weight	l kg	1.8 kg	l kg	4.6 kg	7.7 kg	7.7 kg	4.6 kg	7.7 kg
Battery capacity (recommendation)	25-150 Ah	50-300 Ah	25-100 Ah	100-500 Ah	200-1000 Ah	200-1000 Ah	50-250 Ah	100-500 Ah
OPTIONS								
Remote CC (art. no. 70405030)**	n.a.	yes	n.a.	yes	yes	yes	yes	yes
Model C4-RB (art. no. 70404100)	n.a.	n.a.	n.a.	yes	yes	yes	yes	yes
Model C3-RS (art. no. 70403040)	n.a.	yes	n.a.	yes	yes	yes	yes	yes
Masterlink/MICC (art. no. 70403105)	n.a.	yes	n.a.	yes	yes	yes	n.a.	n.a.
System Manager MICC (art. no. 70400115)	n.a.	n.a.	n.a.	yes	yes	yes	n.a.	n.a.
MasterAdjust communication connection	QRS232	QRS232	QRS232	QQRS232	QRS232+RS485	QRS232	QRS232+RS485	QRS232+RS485
Universal connection cables for remote controls	6 metre: art. no. 6502	2001030 / 10 metre: art. n	o. 6502100100 / 15 metre: art.	no. 6502100150				
TECHNICAL SPECIFICATIONS								
Power factor regulation	>0.95	0.99	>0.95	>0.95	>0.95	>0.95	>0.95	>0.95
Full load consumption (230 V AC)	170 Watt	440 Watt	210 Watt	1800W	3500 Watt	3500 Watt	1800 Watt	3500 Watt
Temperature compensation by means of a temp. sensor	n.a.	-30mV/°C	n.a.	-60 mV/°C	-60 mV/°C	-60 mV/°C	-120 mV/°C	-120 mV/°C
Voltage compensation	automatic	automatic	automatic	sense-connection	sense-connection	sense-connection	sense-connection	sense-connection
DC consumption with connected battery	<10 mA	<10 mA	<5 mA	<5 mA	<5 mA	<5 mA	<5 mA	<5 mA
Temperature range	0°C to +60°C, fully s	afeguarded against overhea	ating and short circuiting	0°C to +60°C, fully sa	feguarded against overheati	ng and short circuiting		
Cooling	natural cooling	vario fan	natural cooling	vario fan	vario fan	vario fan	vario fan	vario fan
Sound level	<30 dBA	<54 dBA	<30 dBA	<54 dBA	<54 dBA	<54 dBA	<54 dBA	<54 dBA
Protection degree	IP65	IP21	IP65	IP23	IP23	IP23	IP23	IP23

generic emission and interference standard: EN 55014-1:1993, generic harmonic current emissions:

electrical fast transients: EN 61000-4-4:1995, surge transient: EN61000-4-5:1995, conducted radio

Approvals



frequency interference: EN61000-4-6:1996, voltage dips: EN 61000-4-11:1994



EN61000-3-3:1995, generic & safety accreditations immunity standard: EN 55014-2:1997, electrostatic discharge: EN 61000-4-2:1995,



#### Mastervolt Guarantee Plan



<sup>\*</sup> Autoranging: operates on 120 V and 230 V, charge current reduction at 120 V: 20 to 30%.

<sup>\*\*</sup> T-connection necessary to connect both temperature sensor and remote CC, art. no. 21730200.

<sup>\*\*\*</sup> Galvanic isolation RS485 communication port.

- 12 V AGM batteries: sealed batteries with glass fibre technique. For cyclic application.
- 12 V gel batteries: sealed batteries with electrolyte in a gel substance. For intensive cyclic application.
- 2 V gel batteries: extremely durable, absolutely maintenance-free batteries. For larger systems with intensive deep cycle application.

These batteries are extremely suitable for use in solar and back up power applications.

Mastervolt batteries can be shipped by air freight, 'non-hazardous' declaration available on request.

	V and Market	Karaman Andrews	Accress AM	Marrayout AM	2		Town Assert			W -
	AGM 12/70 12V	AGM 12/90 12V	AGM 12/160 12V	AGM 12/225 12V	MVG 12/25 12V gel	MVG 12/55 12V gel	MVG 12/85 12V gel	MVG 12/120 12V gel	MVG 12/140 12V gel	MVG 12/200 12V gel
Article no.	62000700	62000900	62001600	62002250	64000250	64000550	64000850	64001200	64001400	64002000
Nominal voltage	12 V	12 V	12 V	12 V	12 V	12 V	12 V	12 V	12 V	12 V
Capacity C20*	70 Ah	90 Ah	160 Ah	225 Ah	25 Ah	55 Ah	85 Ah	120 Ah	I40 Ah	200 Ah
Dimensions, lxwxh in mm (excl. poles)	348x167x178	330x173x212	485×170×242	522x240x218	164x173x126	253×133×208	330×171×214	475×178×195	475×210×195	475×265×216
Dimensions, lxwxh in inches (excl. poles)	13.7x6.6x7.0	13.0x6.8x8.3	19.1x6.7x9.5	20.6x9.4x8.6	6.46×6.81×4.96	9.96x5.24x8.19	12.99x6.73x8.43	18.70×7.01×7.68	18.70x8.27x7.68	18.70×10.43×8.50
Dimensions, lxwxh in mm (incl. poles)	348x167x181	330x173x237	485×177×242	522x240x241	167x176x126	261x136x230	330×171×236	513x189x223	513x223x223	518×274×238
Dimensions, lxwxh in inches (incl. poles)	13.7x6.6x7.1	13.0x6.8x9.3	19.1x6.7x9.5	20.6x9.4x9.5	6.57x6.93x4.96	10.28x5.35x9.06	12.99x6.73x9.29	20.20x7.44x8.78	20.20x8.78x8.78	20.39x10.79x9.37
Weight in kg	22.2 kg	30 kg	43 kg	64 kg	9,6 kg	19 kg	32.6 kg	41 kg	49 kg	70 kg
Weight in Ibs	49 lbs	66 lbs	95 lbs	141 lbs	21.2 lbs	41.9 lbs	71.9 lbs	90.4 lbs	108 lbs	154.3 lbs
Max. installation angle	180°	180°	180°	180°	180°	180°	180°	180°	180°	180°
Cold starter current DIN	617A	885A	1518A	1980A	110A	230A	270A	450A	540A	630A
Cold starter current SAE	705A	1012A	1722A	2261A	175A	380A	450A	760A	920A	1100A
Start in kW, diesel					30	50	70	130	160	175
Start in kW, petrol					38	65	90	155	190	220
Short circuit current (IEC 60896-21)	1620A	2000A	3500A	3650A	583A	1403A	2018A	2475A	3132A	3606A
Guarantee period	2 year	2 year	2 year	2 year	2 year	2 year	2 year	2 year	2 year	2 year

<sup>\*</sup> C20 stands for battery capacity at a discharge time of 20 hours, at a surrounding temperature of 20° C for gel batteries and 25° C for AGM batteries.

	M												
	MVSV 280 2 V gel cell	MVSV 420 2 V gel cell	MVSV 500 2 V gel cell	MVSV 580 2 V gel cell	MVSV 750 2 V gel cell	MVSV 1000 2 V gel cell	MVSV 1250 2 V gel cell	MVSV I500 2 V gel cell	MVSV 1650 2 V gel cell	MVSV 2200 2 V gel cell	MVSV 2700 2 V gel cell		
Article no.	68000280	68000420	68000500	68000580	68000750	68001000	68001250	68001500	68001650	68002200	68002700		
Nominal voltage	2 V	2 V	2 V	2 V	2 V	2 V	2 V	2 V	2 V	2 V	2 V		
Ah capacity / C10*	280 Ah	420 Ah	500 Ah	580 Ah	750 Ah	1000 Ah	1250 Ah	1500 Ah	1650 Ah	2200 Ah	2700 Ah		
Ah capacity / C100*	300 Ah	400 Ah	500 Ah	600 Ah	720 Ah	960 Ah	1200 Ah	1400 Ah	1700 Ah	2300 Ah	2900 Ah		
Dimensions, lxwxh in mm (excl. poles)	125×207×357	125x207x473	146×207×473	167x207x473	146x207x648	211x192x647	211x234x648	211x276x6548	211x276x798	214x399x775	214x488x774		
Dimensions, lxwxh in mm (incl. poles)	125×207×401	125×207×517	146x207x517	167x207x517	146x207x693	212x192x693	211x234x693	211x276x693	211x276x843	214x399x819	214x488x819		
Installation length	134 mm	134 mm	155 mm	176 mm	155 mm	210 mm	220 mm	220 mm	220 mm	223 mm	222 mm		
Number of pole pairs	I .	1	I .	T.	I	2	2	2	2	3	4		
Weight	22 kg	32 kg	37 kg	42 kg	50 kg	68 kg	82 kg	98 kg	II2 kg	153 kg	196 kg		
Guarantee period	7 year pro rata,	7 year pro rata, ask for comprehensive terms					7 year pro rata, ask for comprehensive terms						

A I2 V battery set consists of six 2 V elements while a 24 V configuration consists of twelve elements. The sets are supplied complete with connection cables to connect the poles. All models are suitable for both horizontal and vertical mounting, rack or stack configuration allowed.





#### Mastervolt Guarantee Plan





<sup>\*</sup> C10 stands for capacity at a discharge time of 10 hours, at a surrounding temperature of  $20^{\circ}$  C. C100 stands for capacity at a discharge time of 100 hours, at a surrounding temperature of  $20^{\circ}$  C.

<sup>• 2-</sup>year product warranty • 7-year product warranty (2V cells) • worldwide service

There are different kinds of rechargeable batteries. The most common and widespread type is the lead-acid battery. A less familiar one is the nickel-cadmium (NiCad) battery, which can still often be found in old emergency power systems. Due to the complex charge method required by a NiCad battery, and the fact that they are environmentally unsound, these batteries are not suitable for use onboard a boat.

#### The principle of the lead-acid battery

A battery is a device that stores electric power in the form of chemical energy. When necessary, the energy is again released as electric power for DC consumers such as lighting and starter motors. A battery consists of several galvanic cells with a voltage of 2 Volt each. For a 12 Volt battery, six cells are linked in series and fitted inside a single casing. To achieve 24 Volt, two 12 Volt batteries are linked in series. Each cell has positive oxidised lead plates and negative lead metal plates, and has an electrolyte consisting of water and sulphuric acid. During discharging, the lead oxide on the lead plates is converted into lead. The acid content decreases because sulphuric acid is required for this process.

To recharge the battery, an external power source - such as a battery charger, alternator or solar panel - with a voltage of around 2.4 Volt per cell must be connected. The lead sulphate will then be converted back into lead and lead oxide, and the sulphuric acid content will rise. There are limits set for the charge voltage to prevent the release of an excessive amount of hydrogen. A charge voltage of more than 2.4 Volt per cell, for instance, releases a lot of hydrogen gas, which can form a highly explosive mixture with the oxygen in the air. The upper limit on charge voltage for a 12 Volt battery is 14.4 Volt, and the corresponding value for a 24 Volt battery is 28.8 Volt. The relationship between how full a battery is and the specific gravity of the water/sulphuric acid mixture is as follows:

percentage charged	battery voltage	specific gravity	percentage discharged
0%	I I.64 Volt	1.100	100%
20%	I I.88 Volt	1.140	80%
40%	12.09 Volt	1.175	60%
60%	12.30 Volt	1.210	40%
80%	12.51 Volt	1.245	20%
100%	12.72 Volt	1.280	0%

Different types of battery - in terms of the thickness and number of plates per cell - correspond to different applications. The maximum current that can be delivered is determined by the total plate surface. The number of times that a battery can be discharged and recharged - the number of cycles - depends on the thickness of the plates. A battery can feature either many thin plates or a few thick ones.

#### The starter battery

A starter battery has many thin plates per cell, leading to a large total plate surface. This type of battery is, therefore, suitable for delivering a high level of current over a short period of time.

The number of times that a starter battery can be heavily discharged is limited to around 50. But as starting the engine uses only a small part of the energy stored (around 0.01%), the battery lasts for many years. This type of battery is unsuitable for cyclical use as a service battery. Mastervolt's AGM and gel batteries are suitable to be used as starter batteries.

#### The semi-traction battery

A semi-traction battery has fewer but thicker plates in each cell. These batteries supply relatively less starter current, but can be discharged more often and to a greater extent (approximately 300 full cycles). This kind of battery is highly appropriate for the combined function of starter/service battery. Mastervolt recommends to use maintenance free 'deep cycle' AGM or gel batteries (see previous pages). It is important to charge the batteries according to the appropriate charge characteristic.

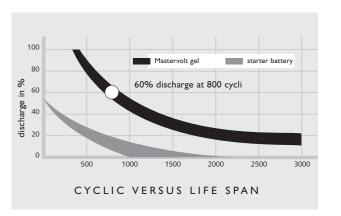


'Sealed' traction battery.

#### The traction battery

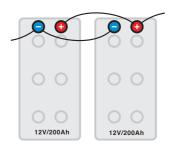
This type of battery has even fewer, but very thick, flat or cylindrical plates. It can therefore be discharged many times and fairly completely (1000 full cycles). This is why wet traction batteries are often used in forklifts and industrial-grade cleaning machines. But wet traction batteries require a special charge method. Because these batteries are mostly tall, they are sensitive to the accumulation of sulphuric acid at the bottom of the battery container. This phenomenon is called stratification and occurs because sulphuric acid is denser than water.

Acid content increases in the lower part of the battery, locally intensifying plate corrosion, and decreases in the upper part, reducing capacity. The battery is discharged unevenly, significantly reducing the life span. In order to spread out the acid evenly again, the battery has to be purposefully overloaded using excessive voltage. This generates a large amount of hydrogen gas, which will form a dangerous mixture with oxygen in the air. The voltage required to recharge these batteries is around 2.7V per cell, or 16.2V for a 12V system and 32.4V for a 24V system. These high levels of voltage are extremely dangerous for the connected equipment and the large amount of gas generated makes these batteries unsuitable for use on board boats. Mastervolt recommends to install maintenance free 2 volt gel cells. An appropriate charge protocol should be followed.



#### Parallel connection

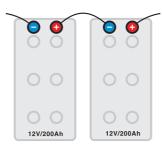
Parallel coupling involves connecting the plus poles of multiple batteries to each other and the same with the minus poles. The plus of the first battery and the minus of the last battery are then connected to the system. This type of arrangement is used to increase capacity (in this case 400 Ah).



12V/400Ah parallel coupling.

#### Series connection

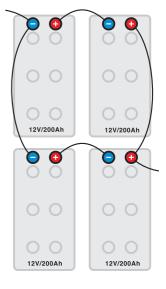
Batteries are coupled in series to gain higher voltage, for instance 24 or even 48 Volt. The plus pole of each battery is connected to the minus pole of the following one, with the minus pole of the first battery and plus pole of the last battery connected to the system.



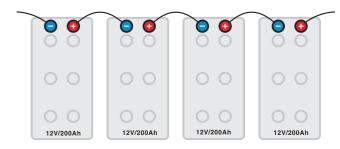
24V/200Ah series connection.

#### Series/parallel connection

A combination of series and parallel connections is required if you need for example a 24 Volt battery set with a higher capacity. The battery should then be cross-wired to the system using the plus pole of the first and minus pole of the last battery.



24V/400Ah series/parallel connection



48V/200Ah series connection.





# remote panels

A Mastervolt battery monitoring system brings an end to unpleasant surprises. A clear display shows performance, consumption and available battery capacity. Below we have listed the available monitoring panels for Mass Sine, Mass Combi and Dakar Combi models.

17 MAIL NAME	
1017 1 Dil. 10 20.200 S.A	



danish, finnish, norwegian & swedish









		Manager sacres success on as	Management and a series despite	American .	Till of the P	
	Masterlink MICC	Masterlink BTM-III	Masterlink DCV	Dakar Power Centre Control	Modell ICC für Mass Combi (Standard)	C-4-RI
Article no.	70403105	70403163	70403180	55002045	70405000	70404110
Application	Battery consumption meter, 12/24 V DC with LCD readout. Remote control for Mass Sine inverter and charger or Mass Combi.	Battery consumption meter, 12/24 V DC with LCD readout and LED bar. Also available for 48 V DC.	Battery condition meter for three independent batteries, 12/24 V DC.	Extensive remote control for Dakar Combi. LCD display of battery consumption, voltage, amperes and battery status.	Indication of DC consumption, charge phase, failure and AC availability. With on/off/ 'charger only' switch.	Remote control on/off for Mass sine wave inverter.
TECHNICAL SPECIFICATIONS						
Number of battery sets	service (fully) & starter (voltage)	service, starter & bowthruster	service, starter & bowthruster	I battery bank	I battery bank	n.a.
Max. Amp-hour capacity	9999 Ah	9999 Ah	9999 Ah	9999 Ah	n.a.	n.a.
Readout voltage	yes	yes	yes	yes	yes	n.a.
Readout current	yes	yes	n.a.	yes	yes	n.a.
Readout Amp-hours	yes	yes	n.a.	n.a.	n.a.	n.a.
Time remaining indication	yes	yes	n.a.	n.a.	n.a.	n.a.
Battery capacity in %	yes	yes	yes	yes	yes	n.a.
Extra LED indication	battery capacity in %, charge status battery charger	battery capacity in %, charge status battery charger	n.a.	n.a.	n.a.	n.a.
Inverter operation	yes	n.a.	n.a.	yes	yes	yes
Battery charger operation	yes	n.a.	n.a.	yes	yes	n.a.
'Power Sharing' adjustment	yes	n.a.	n.a.	yes	n.a.	n.a.
Compatible with MasterVision	yes	yes	yes	n.a.	n.a.	n.a.
Current consumption (backlight off)	28 mA/12 V - 26 mA/24 V	14 mA/12 V - 11 mA/24 V	I5 mA	28 mA/12 V - 26 mA/24 V	n.a.	n.a.
Current consumption (backlight on)	100 mA/12 V - 50 mA/24 V	100 mA/12 V - 50 mA/24 V	100 mA/12 V - 50 mA/24 V	100 mA/12 V - 50 mA/24 V	n.a.	n.a.
Supply voltage	9-35 V DC	9-35 V DC*	9-32 V DC	n.a.	n.a.	n.a.
Voltage range measurement	7-35 V DC	7-35 V DC*	7-32 V DC	7-65 V DC	7-35 V DC	n.a.
Voltage resolution	0.05 V	0.01 V	0.1 V	0.08 V	n.a.	n.a.
Voltage deviation	$\pm$ 0.6% $\pm$ 1 figure	± 0.6% ± 1 figure	± 0.6% ± 1 figure	± 0.6% ± 1 figure	n.a.	n.a.
Amps measurement range	0-500 A	0-500 A	n.a.	0-500 A	n.a.	n.a.
Shunt specification	500 A / 50 mV (service set)	500 A / 50 mV (service set)	n.a.	n.a.	n.a.	n.a.
Dimensions instrument, wxh.	120 x 65 mm	120 x 65 mm	120 x 65 mm	136 x 93 mm	120 x 24 mm	60 x 65 mm
Built-in depth incl./excl. cover box	55 mm / 40 mm	55 mm / 40 mm	55 mm / 40 mm	26 mm	18.5 mm	
Weight instrument incl. shunt	0.9 kg	0.9 kg	0.25 kg	159 gr	I 40 gr	
Dimensions shunt, hxwxd.	84x44x44 mm - M8	84x44x44 mm - M8	n.a.	n.a.	n.a.	n.a.
Battery alarm contact	yes, potential free	yes, open collector	yes, open collector	yes, open collector	yes, open collector	n.a.
Connection cable (6-wire) necessary Art. no. 6801601200	yes	yes	yes	yes	yes	n.a.
Modular cable necessary	yes, 2 pcs	n.a.	n.a.	yes, I pc	yes, I pc	n.a.
Languages	english	english, dutch, french, german, italian,	english	english	english	english



#### MasterBus

All communication between Mastervolt system components takes place via MasterBus, which is a closed arrangement that is inaccessible to other systems.

#### MasterBus PC-Link

The MasterBus PC-Link is an interface that enables communication between desktop/laptop PCs and Mastervolt system components. It is possible to customise various functions to the specific requirements of your energy system.

#### MasterAdjust

MasterAdjust is software that allows settings to be changed within an appliance, and provides the possibility to activate and disable specific functions of the system components. It is available as freeware on our website.

#### MassNet

While Mastervolt system components are linked among themselves via MasterBus, they use MassNet to communicate with the outside world. MassNet makes it possible to integrate Mastervolt system information and operation with boat management systems. This protocol is open to anyone who wishes to use it.

#### MasterBus-MassNet Link

The connection of MasterBus to MassNet is made with the help of a special interface, the MasterBus-MassNet Link.

#### MassView

MassView is Mastervolt software designed to enable monitoring, operation and control of a Mastervolt system through a PC, laptop or Mastervolt control panel. This allows you to keep a 'remote' eye on the system.

#### MasterAdjust software

Mastervolt offers you a range of useful MasterAdjust Software on its website. This software can be used by the installer to accurately tune Mastervolt equipment to its relevant application and allows various parameters to be read and set according to need. Parameters such as voltage, current, switch-off points and charging algorithms are just a few of the many options for adjustment.



MasterBus PC connection.

In order to make use of MasterAdjust software, you will usually need a MasterBus PC-Link to serve as an interface between your computer/laptop and Mastervolt equipment (art. no. 21730100). This MasterBus PC-Link can be directly connected to a computer serial port.

#### Overview of the available software

Mastervolt aims to create the broadest package of software for as many products as possible. The software available will be continuously expanded in the coming years. Check our website regularly for the latest updates.

#### Mass Combi MasterAdjust software

The Mass Combi MasterAdjust software allows you to easily check the status of the charger, inverter and transfer system, and to set the parameters of your Mass Combi so as to meet your personal requirements. Although the Mass Combi can be directly installed and used without the need for calibration, a Mastervolt installer can (by means of a password and the Mastervolt website) access more advanced functions. This way, the Mass Combi can be set and calibrated according to the specific technical requirements of the electrical installation.

Mass Combi MasterAdjust software is suitable for the following equipment in the Mass Combi range:

Article no.	Model
36011205	Mass Combi 12/1200-60 A
36012005	Mass Combi 12/2000-100 A
36014005	Mass Combi 12/4000-200 A
36021205	Mass Combi 24/1200-35 A
36022005	Mass Combi 24/2000-60 A
36024005	Mass Combi 24/4000-120 A

The functions described below are available as standard. The first screen, Status Overview, gives you a complete and instant overview on the status of your Mass Combi. The readings and settings of the Combi are indicated both graphically and numerically:



AC-system: • Voltage • Current • Load • Operation mode

• Monitoring and setting the Power Sharing mode.

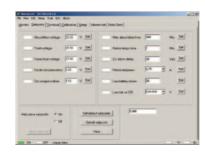
DC-system: • Voltage • Current • Load • Error diagnosis

• Charge current • Status of the three-step charge characteristic (bulk, absorption and float).

You can monitor and adjust all variables in the screen Setpoints:

#### Changing the settings of the battery charger

- Maximum voltage in the bulk charge phase.
- Maximum charge voltage in the absorption phase.
- Output voltage in the float phase.
- The undervoltage level for the starting of a new charge cycle.
- Forced float voltage: constant output voltage in two-step charger mode.
- Voltage compensation for the use of gel or AGM batteries.
- Return amps: the output current of the battery charger at which the battery is considered to be fully charged.
- Maximum charge current.
- Maximum duration of the bulk phase.
- Return to bulk time: delay before the start of a new charge cycle.
- $\bullet\,$  Minimum duration of the absorption phase.
- Maximum duration of the absorption phase.



**Reading the dipswitch settings:** • Parallel mode • Output frequency of the inverter • Energy saving mode • Power Sharing mode • Power Support mode • Settings regarding battery type (open, gel, AGM) • Equalisation charging.

#### Changing the settings of the AC system:

- Undervoltage limit of the external power supply.
- Inverter output voltage.
- Delay for the switch-off function in case of undervoltage.
- Delay for the switch-on function in case of undervoltage.

#### Programming battery alarm functions:

- Alarm switch on high: overvoltage level above which the alarm function is activated.
- Alarm switch off high: battery voltage at which the alarm function is turned off after an overvoltage alarm.
- Alarm switch on low: undervoltage level below which the alarm function is activated.
- Alarm switch off low: battery voltage at which the alarm function is turned off after an undervoltage alarm.
- Delay time: setting to prevent the alarm from reacting to a momentary voltage drop.
- Alarm load level: level of inverter output current above which the alarm function is activated.
- · Programming the alarm contact.
- Generator start/stop signal: setting to start the generator if the inverter load is too high.



The Historical Data screen gives you an overview of the past operation of your Mass Combi. The historical charge current and charge voltage are also shown in graph form.

- Number of Ah supplied back to the batteries.
- Total number of kWh supplied by the inverter.
- Total duration of inverter operation.
- Total duration of battery charger operation.
- Number of times that the inverter was switched off due to overloading.
- Number of times that the inverter was switched off due to high temperature.
- Lowest observed battery voltage.
- Number of fully completed charge cycles.
- Number of interrupted charge cycles.
- Highest measured voltage of the external power source.
- Number of times that the Combi was switched off due to excessive or insufficient battery voltage.

#### Technical definitions

#### Amorphous silicon solar cells

The term amorphous refers to the non-crystalline structure of silicon atoms. The efficiency is lower than crystalline silicon, and typically ranges from 5% to 10%. The energy yield per installed Watt peak is higher compared to crystalline silicon modules because of the relatively high efficiency at low irradiation.

#### Autonomous PV systems

Supply electricity to locations where no public grid is available or a long distance from that grid. In such situations, a PV system is significantly cheaper than connecting to the mains or a non-stop generator.

#### **Energy-neutral building**

A building where the balance between energy production and energy consumption is zero on a yearly basis. This can be achieved by installing various renewable energy sources like PV cells, hot water systems, heat pumps etc.

#### Grid connected PV system

The low voltage direct current (DC) electricity is converted to 230 V alternating current (AC) power by an inverter. The inverter feeds the electricity, produced by the PV system, back into the utility grid. This means the PV system actually functions as a mini power station. If the solar energy production is higher than the electricity consumption at any given moment, most electricity meters spin backwards. The returned electricity is automatically incorporated in the energy bill.

#### Inverter efficiency

A percentage that indicates which proportion of the incoming solar-generated electricity is being transformed into useful AC energy. Modern high-quality inverters have efficiencies higher than 90%

#### Irradiation

The light intensity in a given area. Africa, for example, receives around twice as much sun as the Netherlands. Irradiation varies within a country too: In the Netherlands for example, it varies between 980 kWh/m² per year in the east to 1070 kWh/m² on the west coast. The average air temperature is also of importance for the annual energy yield of a PV system; solar cells perform better at lower temperatures (see also Underdimensioning).

#### **Maximum Power Point Tracker**

An intelligent voltage regulator that adjusts the operating voltage of the PV array to variations in temperature and cell type. A good MPP tracking algorithm draws the maximum solar power from the PV array in all conditions.

#### Monocrystalline silicon solar cells

Monocrystalline silicon solar cells are cells made from one large monocrystal. Thanks to this method of production we have round solar cells, each made from one silicon crystal. The standard dimensions are 10 by 10 cm. Monocrystalline silicon solar cells typically have an efficiency of 16% to 18%.

#### Output of a PV system

Solar panels have an efficiency that varies between 8% and 18%. The orientation and shading of the panels and the panel temperature can also affect the eventual output.

#### Photovoltaic systems

Also known as PV systems. The word Photovoltaic is a combination of the Greek word for light and the name of the physicist Alessandro Volta. It denotes the direct conversion of sunlight into energy by means of solar cells.

#### Polycrystalline/multicristalline silicon solar cells

Solar cells made up of multiple silicon crystals. As the crystal edges can impede the electron flow, multicrystalline silicon solar cells are usually less efficient than the monocrystalline equivalent. The output is usually between 14% and 16%. Most polycrystalline silicon solar cells are blue in colour.

#### Power loss

Power loss can be caused by the location and orientation of the solar cells and other factors such as:

- Placement losses caused by non-ideal orientation to the sun.
- Shading losses: Even partial shading of cells or modules causes relatively high losses.
- Panel losses caused by the electrical resistance of interconnections inside the solar module and losses introduced by series connection of the cells (see String).
- Inverter losses: Solar energy converted to heat and therefore not fed back into the grid.
- Cable losses caused by the electrical resistance of the wiring.
- Temperature losses: solar voltage and power decreases with ±
   0.5% per degree Celsius. This may lead to relatively large losses at full irradiance (see also Underdimensioning).

#### Shading

Shading of solar cells may lead to electrical resistance within a closed current loop. This resistance causes the shaded cells to heat up and, if the temperature rises sufficiently, to break down (the Hot-Spot effect). To prevent this, small groups of cells are protected by a bypass diode that stops the shaded solar cells from heating up.

#### Silicon

Raw material for solar cells.

#### Solar cell

In a solar cell, light energy (photons) is converted into electric power. See also Working principle of a solar cell.

#### Solar energy applications

- The active or passive heating of buildings.
- The heating of tap water.
- The generation of electricity (photovoltaic solar energy or PV).

#### Solar panel

A group of PV cells combined in one unit.

#### STC or standard conditions

Conditions used to set the panel capacity: a cell temperature of 25° C and light intensity of 1000 W/m<sup>2</sup>.

#### String

A group of solar cells (or solar panels) connected in a series. When solar cells or modules are series-connected, the voltage will add up with the number of cells/modules, while the current is equal to the current of one cell. Because of the relatively low current, electrical losses in wiring are low as well. A string of cells or modules performs only as well as the worst cell/module in the string. If differences between solar cells or panels are significant, it may be worthwhile separating lower performance modules from higher and combining them into separate strings. If cells, modules or strings are connected in parallel, the current will add up with the number of units connected in parallel, while voltage remains constant. With both parallel or series connection, the total power generated is the sum of all the power generated by the connected solar cells.

#### Underdimensioning

Means that the nominal input power of an inverter is less than the power of the PV array, expressed in kWp. In one year, the solar array will seldom generate the specified Watt peak power. In Northern Europe, the inverter input power can generally be chosen to be around 80% of the PV capacity without introducing significant losses.

#### Watt peak (Wp)

A measure of the electrical power a solar cell or module will generate at standard conditions. See also STC.

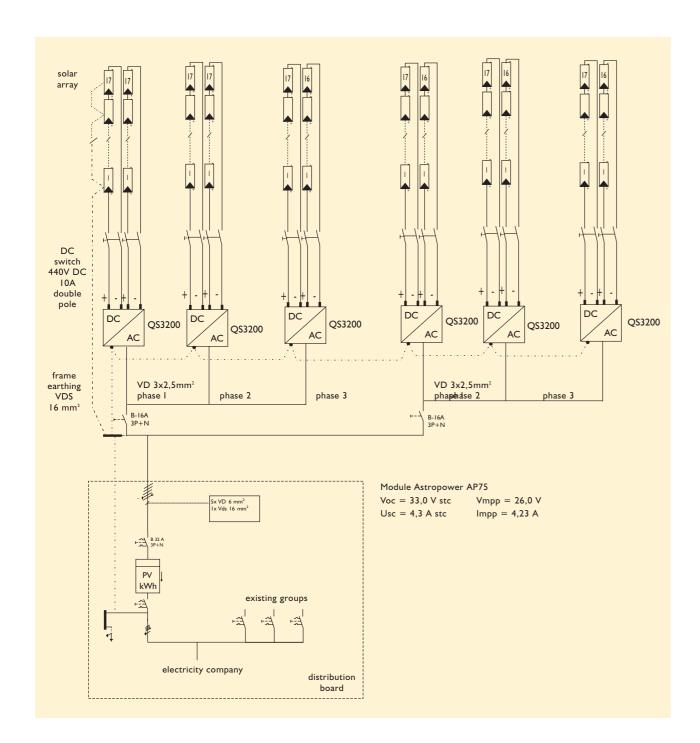
#### Working principle of a solar cell

Solar cells consist of two layers of semi-conducting material, usually silicon. Between these two layers, the n-layer above and the p-layer below, is an electric field. When sunlight shines on the n-layer it is partly absorbed by the semi-conductor and converted into energy (heat). This energy generates electrons that are free to move through the material. The crystalline structure of the silicon and the electrical field ensure that the free electrons move in a certain direction. This phenomenon is called electricity, and the flow is taken from the cell for use in external applications.





## System example - grid connected



#### 15 kWp system installed in Greece

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This system was installed at the end of 2003 by a local Greek company on a building near Athens. A total of 200 75 Wp Astropower solar panels supply 15 kWp of power for local consumption and returning to the grid. Six Sunmaster QS3200 inverters are placed between the solar panels and the grid. This is a powerful system that meets the required energy needs virtually autonomously.

## Frequently asked questions on PV systems

#### I) What is the best angle for solar panels?

The optimal angle for placing solar panels is  $50^{\circ}$  for systems in Nordic countries and  $35^{\circ}$  for South-European countries.

# 2) How much power will I lose if panels are incorrectly placed?

A system set at an angle of between 20 and 50° facing south will produce around 5% less power per year. When panels are installed at an angle of 35° and the system is oriented between south east and south west, the energy shortfall on an annual basis will again be around 5%.

#### 3) How does heat affect my system?

The output of a system is reduced when panels become warmer. The power shortfall can be 0.3 to 0.5% per  $^{\circ}$ C.

#### 4) What is the life span of a solar panel?

With proper maintenance, the modules should last at least 30 years.

#### 5) How long do inverters last?

You should expect an inverter to function for at least ten years. The actual figures depend on the location of the inverter (the hotter the temperature, the shorter the life span) and whether or not regular maintenance is carried out. A humid environment will affect the life span as well. The ideal place to install an inverter is always in a dry and preferably conditioned environment.

#### 6) Is it possible to remotely collect system data?

There are various options for accessing inverter data. See this brochure for more information or ask your supplier for advice.

#### 7) Do the panels have to be kept clean?

The modules are in principle maintenance free and the panels are washed clean by rain. It is worth considering cleaning the panels with water once every year.

#### 8) What happens if the grid breaks down?

The solar energy unit will stop returning power to the grid. This is necessary to ensure the safety of the system at times when maintenance is being carried out or there is a failure on the grid. Please consult your supplier if you wish to keep receiving a 230 volt current when the grid shuts down. Mastervolt has various handy options for providing emergency power.

#### 9) Do the panels also provide electricity doing cloudy

#### weather?

The panels continue to produce energy even when it is cloudy, albeit on a smaller scale.

#### 10) Can I connect equipment directly to the panels?

Equipment cannot be connected directly to a grid connected solar installation - an electricity grid is always necessary.

AC consumers can be directly connected to grid independent sine wave inverters in island systems.

# 11) Is there any difference in the electricity coming from a solar system?

No, the current is the same.

#### 12) Can my solar installation attract lightning?

There is no record of this ever occurring. The chance of lightning striking is equal regardless of whether or not you have a solar system.

# 13) Can a solar installation cause damage to my household equipment?

No, this is not possible. The inverter functions as a sort of filter between the grid and the PV system and complies with the highest suppression standards.

# 14) What happens to the electricity that has been generated but not used?

The electricity generated by the solar panels is first consumed by the various equipment in the building concerned. Any excess power produced is returned to the public grid. Make sure you request from your energy supplier a meter that turns backwards if one is not already installed.







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